A Groundwater Reconnaissance Survey of the Sacramento Valley, Big Sandy Valley, Detrital Valley, Hualapai Valley and the Meadview Watershed.

Gavin Fielding
University of Arizona
November 1, 2001

Abstract

The main purpose of this study was to conduct a groundwater reconnaissance survey and preliminary hydrologic assessment of the Sacramento Valley, Big Sandy Valley, Detrital Valley, Hualapai Valley and the Meadview Watershed in Mohave County, Arizona. A second, parallel aim was to gather together in a single place, all the studies, data, reports, etc. that relate to the water resources of the area. When it was not possible to obtain hard copies of documents, their location and information on how to view them has been included. In March 2001 the grant applicants (the Northwest Arizona Watershed Council) requested that the project be refocused specifically on the Sacramento Aquifer.

The most significant finding about the Sacramento Valley Basin aquifer is that estimates of water in storage vary from 2.3 million ac-ft to 13 million ac-ft depending on the assumptions made. This study narrows down the estimates and explains how a more accurate estimate can be achieved. Recommendations for future studies that would create a more accurate estimate have also been included.

The one certainty about the water supply in the Sacramento aquifer is that the population and the water use are increasing. The population growth in the Golden Valley portion of the aquifer has been at 8% a year since 1990. In some areas of the aquifer the water table has been dropping at a foot a year for at least the last 30 years.

Overview

In mid-2000, a need had been identified by the Northwest Arizona Watershed Council to gather together all the available information on present and future groundwater supplies in Mohave County south of the Colorado River. The area of land being developed and the size of the population in and around Kingman have been growing rapidly in recent years. In addition to this, large water users (such as a new 2000 bed Prison, and the Griffith energy plant) were attracted to the large open spaces of the Sacramento Valley where there are low land prices and an infrastructure that has already been developed. It is anticipated by the county government that this type of growth will continue for many decades into the future.

The purpose of this survey is to provide an impartial central source of information to the decision makers within the county so that solutions to water supply problems can be anticipated in advance and plans altered accordingly. It was envisioned that the best approach to do this was to conduct a meta-data reconnaissance survey. The advantage of a reconnaissance survey is that it is relatively quick, inexpensive and wide ranging, and it provides direction in how to apply limited grant funding in the future to maximum benefit. The idea of partnering with the University of Arizona was presented to the watershed council by Rob Grumbles of the University of Arizona Watershed Extension Program. A proposal was then written by the watershed council in conjunction with the Department of Renewable Natural Resources and the Department of Hydrology and Water Resources for a grant under the Arizona Rural Watershed Initiative.

A brief background on the Rural Watersheds Initiative - The Arizona Department of Water Resources has been working with rural communities to help them develop locally driven partnerships to address water supply issues on a regional scale. These communities, while willing to work within a watershed partnership, lacked the necessary resources to address many of their problems. At the Governors request, the State Legislature appropriated $1.2 Million to ADWR in FY2000 to begin the Arizona Rural Watershed Initiative.

Early in this project, the Northwest Arizona Watershed Council requested a change in the focus of the survey from a more generalized view of the 5 watersheds to a closer look at the Sacramento Valley aquifer. The momentum for this decision came from concerns about the construction of the Griffith Energy plant and the new prison. Both of which are large water users, and both are extracting water from the same Sacramento Valley aquifer.
It was anticipated that questions arising about the water supply in the Big Sandy Valley would be fully answered in the Draft EIS being produced for the proposed Big Sandy Energy Plant at Wikieup. However, in July 2001 after the report came out, I was informally asked by the Northwest Arizona Watershed Council and the Planning and Zoning Commission to look over the DEIS using the same techniques I had applied to all other reports. In the DEIS I noticed some potential errors in the hydrology section of the report so I documented those concerns and sent them to both the Northwest Arizona Watershed Council and the Mohave County Planning and Zoning Commission. These comments were later used in the line siting committee hearings as evidence against the suitability of such a heavy water use energy plant in the Big Sandy Valley.

At the present time, (Nov 1st 2001) the decision by the line siting committee to deny a Certificate of Environmental Compatibility (CEC) is being appealed through the Arizona Corporation Commission. As such, any figures on the available water supplies of the Big Sandy valley are open to debate. Other reports on the Big Sandy Valley that have been located are recorded in the relevant document list.

Sacramento Valley Basin Watershed

The Sacramento Valley Basin Watershed covers approximately 1400 square miles and is located to the southwest of Kingman, separated from the Colorado River by the Black mountains on the west and the Mohave Mountains in the southwest. The northeast is bounded by the Cerbat Mountains and the east by the Hualapai mountains. The Sacramento Valley Basin can be divided into three areas.

(1) The Sacramento Valley Aquifer which is approximately 310 square miles (Griffith Energy plant Draft EIS) goes from the groundwater divide with the Detrital valley to the north to a groundwater gap* at Yucca.

*At Yucca, ridges of bedrock coming into the center of the valley from the Hualapai mountains in the east continue westward underneath the sediment fill. This creates a gap between the bedrock to the west and the bedrock to the east that is approximately two miles wide at the water table. It is through this 'gap' that the entire subsurface outflow of the Sacramento Valley Aquifer has to flow.

(2) To the SSE of Yucca is an area known as the Dutch Flats. The Dutch Flats are at present very sparsely populated. Morphologically, the Bouguer anomaly (gravity survey) maps produced in 1981 strongly suggest that the Dutch Flats sub-basin is very similar to that of the rest of the Sacramento Valley Basin but with 500-100ft more sedimentary fill.

(3) The third part of the Sacramento Valley Basin watershed is along the Sacramento Wash heading west to Topock Marsh. This is also known as the Franconia Narrows. I shall refer to it as such from here on to avoid confusion with any other part of the Sacramento Wash. In the northern part of the narrows there have been some artesian wells drilled (Brad Guay, pers comm. August 2001). This appears to be a localized phenomenon that is unlikely to support any large-scale developments. Over the last 30 years, there have been four different estimates of sub-surface westwards groundwater outflow through the Franconia narrows.

I). The first estimate was by Gillespie and Bentley in 1971 in the USGS Water Supply Paper No.1899-H. Their estimate was 4,000 ac-ft/yr.

II). The second was by Owen-Joyce of the USGS in 1988. Her estimate was 10,000 ac-ft/yr. This was done as a rough estimate for the Bureau of Reclamation's (BOR) Lower Colorado River Accounting System (LCRAS).

III). The third estimate was by the Arizona Department of Water Resources (ADWR) in 1988. Their estimate was only 623 ac-ft/yr. Their estimate is also the only one based on a pump test within the narrows. The pump test was conducted in 1991 on an Arizona Department of Transport well. The results were analyzed by Rascona and Remick of the Arizona Department of Water

Resources (ADWR). Their figure was published in the 1991 Hydrologic Map Series Report No. 21- "Groundwater Levels in the Sacramento Valley". Remick documented their methodology, calculations and conclusions in an ADWR internal memo.

IV). The fourth estimate was by Manera Inc. in 1998 in the report "Griffith Energy Well Field, Preliminary Hydrologic Evaluation". That estimate was 4281 ac-ft/yr. This estimate was made using the water level contours of the 1991 ADWR map report but not the outflow figure published on the same map report.

The geology of the Franconia Narrows is uncertain. Earlier workers have assumed this to be a simple, normal faulted, full graben type structure. However, other evidence suggests that there is also a strong component of strike-slip faulting. The impact this would have on sub surface flow is significant due to the mylonisation of rock and the disturbing of sediments within the fault zones. Vertical mylonised fault bands are unlikely to show up clearly in seismic lines or in drill cores/drill logs. However their effect on water flow would be to significantly reduce the transmissivity of the medium.

The Other Watersheds in this Survey

Early in the year, this survey had been re-focused on the water resources of the Sacramento Valley. As such, only a very brief summary of the other watershed has been included below. For a more complete summary on the Big Sandy Valley, Detrital Valley, Hualapai Valley and Meadview watershed, please consult the ADWR groundwater basin summaries at http://www.adwr.state.az.us/AZWaterInfo/OutsideAMAs/
No documents specific to the Meadview Watershed were found other than the ADWR summary.

Big Sandy Valley

There is currently an ongoing legal dispute trying to quantify the availability of water supplies in the Big Sandy Valley. At present, the largest water user in the valley is the Phelps Dodge Bagdad Mine. They pipe water from the shallow aquifer in this watershed to their mining operations in the Bill Williams Basin in Yavapai County.

Detrital Valley

Very little is known, or is publicly available about the water resources of the Detrital Valley Basin. What is known has been recorded in the ADWR Map Series Report 14 -"Map Showing Groundwater Conditions in the Detrital Wash Basin, Mohave County, Arizona---1987".
The potential presence of heavy metal contamination from mining activities and high fluoride concentrations from the valleys partly volcanic fill may present limits on the usable groundwater resources in the future.

Hualapai Valley

The Hualapai Valley is the principle source of Kingman's water supply providing approximately 6,000 ac-ft/yr. The center of the valley is predominantly composed of bedded red clays, lacustrine deposits, and evaporite deposits. All recharge occurs from the sides of the valley. The City of Kingman had conducted an extensive study of the basin, but unfortunately I was unable to obtain a copy. The existence of that study has been confirmed by more than one credible source.

Methodology of the Reconnaissance Survey

This survey was a meta-data study with twin complimentary aims. The first was to gather together or precisely locate all of the publicly available hydrology related studies that have been produced on the Sacramento Valley, Big Sandy Valley, Detrital Valley, Hualapai Valley and the Meadview Watershed in Mohave County, NW Arizona. The completion of this survey marks the first of its kind in Mohave County. Where some studies were found that were proprietary, the location of these studies has been reported with a contact name where possible.

The second, parallel aim was to complete a preliminary analysis of everything collected. This was done by assessing the methodology used in a study, and then looking at the sources, accuracy and temporal and spatial resolution of the information quoted. By taking this approach, one can assess the basic assumptions made in a study without becoming involved in comparing the merits of using one person's approach relative to another's. If the basic data is insufficient, or faulty/unreliable, then no matter how well a model has been crafted or a calculation completed, the results cannot be relied upon to be an accurate representation of the natural system. The caveat to this is that sometimes the author of a study fully admits where there was a lack of information available and cites this as a limit on the application of the work he/she has done.

The dominant theme I found while working on this survey is that success is dependant on the ability to convince people that this reconnaissance survey really is completely independent and that the eventual purpose of carrying out such a survey is to enable openness in the decision making process as it relates to water resources.
In a desert region such as Mohave County I found that most of the population is very aware that providing a long term, safe water supply is extremely important. When the issues surrounding water are so prevalent in the public consciousness, it makes the collection of information easier. I found that doing interviews with the Kingman Daily Miner and giving dinner presentations to the Mohave County Professional Registrants Association significantly raised the profile of the survey outside of the Northwest Arizona Watershed Council and provided leads that would have otherwise remained invisible. Maintaining a public profile was also helpful in informing members of the public of who I was and how the survey would benefit the residents of the county.

One goal of this reconnaissance survey was to identify ways in which future studies could maximize the amount of useful knowledge with the minimum amount of resources. By highlighting what needs to be done, future funding can be precisely focused. There have been countless examples in science where two nearly identical studies of a system or region have been carried out by different institutions in complete ignorance of each other. A meta-data reconnaissance survey identifies where primary data has already been collected (For example: precipitation data or a gravity data) and what has been interpreted by previously completed studies. This knowledge alone helps prevent duplication and wasting money.

Also, by identifying specific information needs and defining the studies required to satisfy those needs, the time taken to complete an accurate 'Big Picture' of available water resources in the region can be cut by many years.

For example, in this survey I identified that in order to come up with a number for the amount of water in storage in the Sacramento Aquifer, an up to date and detailed geological model is necessary to provide the framework for calculating the amount of, and shape of, sedimentary fill and thus the areal and vertical extent of the aquifer.

By limiting the scope of this meta-data reconnaissance survey so that it did not include performing new work, the cost was relatively low. In contrast, a quantitative assessment of the water resources would require a numerical analysis which is much more expensive because of the amount of raw data that has to be collected.

Data Management

Keeping an accurate and up to date record as the survey progresses is very important. Some of the more important things to note and record are:

- The geographic location of a study area (plotted onto a wall map is useful!)
- A current list of collected information. I recommend using the software Reference Manager, or if you are more familiar with Microsoft Office, using Word or Excel.
- Where exactly a study came from. This includes precise details such as library catalogue numbers, the copyright information of a study, who paid for the study, How much does a copy cost? etc.
- Who provided you with a study? What is their job title?
- When was the study produced?
- Was the study new? Or was it summarizing previous studies?
- The name, title and contact details of people who have helped or provided referrals.
- Individuals who are the most likely to use and benefit from the results of a reconnaissance survey in addition to the group who applied for the funding. Some examples within Mohave County are the employees of the Planning and Zoning Commission and the Bureau of Land Management. Such individuals will likely already have in their possession a significant amount of information in the form of reports and local knowledge.

Information Sources

The first part of this reconnaissance survey was to identify different agencies and sources of information on the Hydrology, Geology, Soil, Ecosystems, and Pollution in the region. Attached to this report is a document that I prepared listing all federal, state and county agencies that were sources or potential sources of information. It also lists some of the companies who are involved in water resources in Mohave County. I hope that this list of institutions will assist others doing similar studies.

If you wish to contact me about this survey, my contact details are:

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University of Arizona
Tucson
AZ 85721

Tel: (520) 621-5211
Fax: (520) 626-7401
E-mail: gavinfieldingaz@yahoo.com

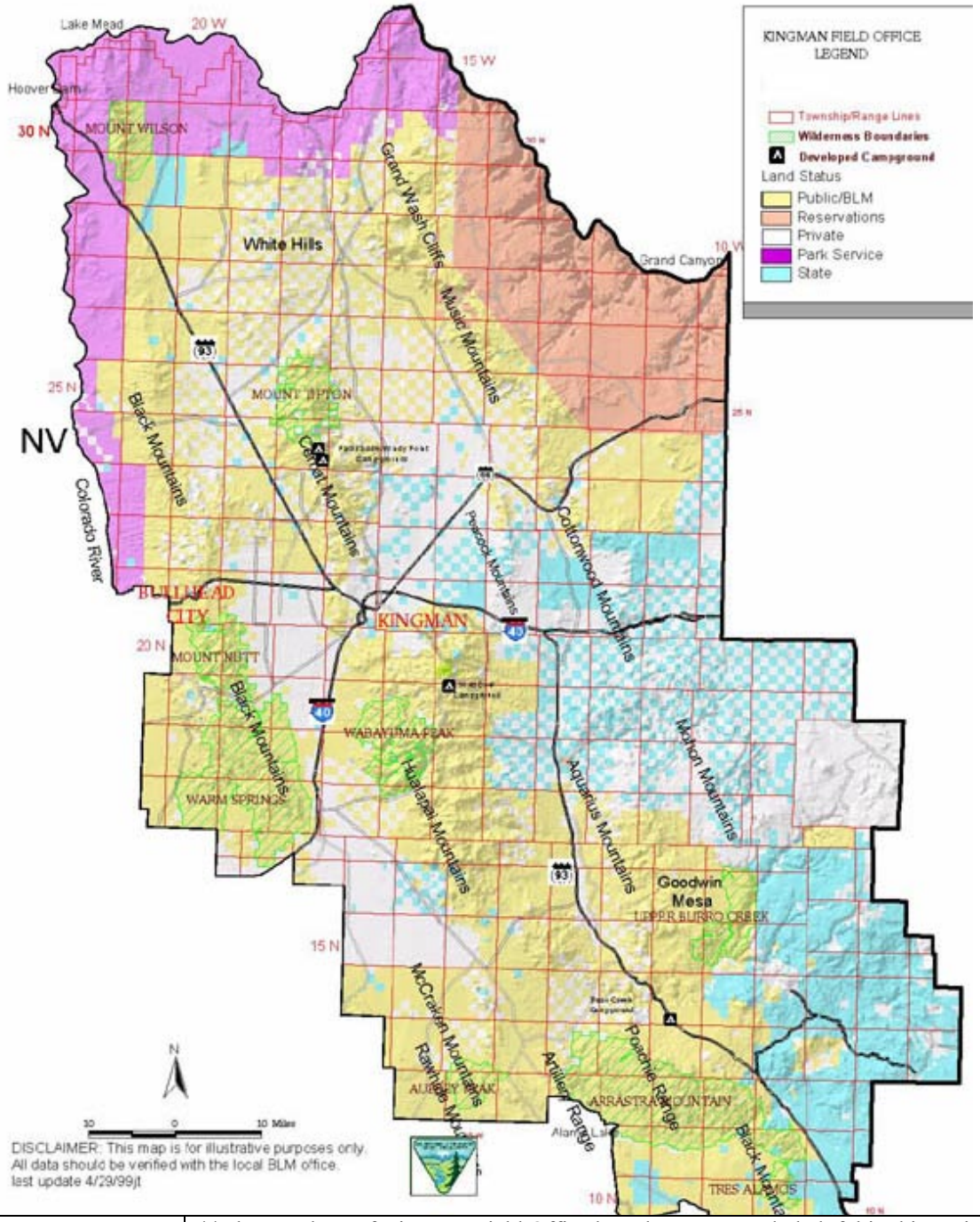
<table>
<tr><th>Institution</th><th>Notes</th></tr>
<tr><td>AGIC</td><td>Arizona Geographic Information Council
www.land.state.az.us/agic/agichome.html
AGIC helps coordinate the development and management of geographic information systems (GIS) and geographic data in Arizona. AGIC ensures that users have access to complete, timely and accurate geographic information. AGIC promotes the use of GIS and related technologies to more effectively and efficiently address problems, develop plans and manage the natural, cultural, economic, and infrastructural resources of the state.
www.land.state.az.us/agic/web_n/web/gis/links.htm
This page has been established to provide a quick reference to many GIS-related web sites in Arizona and across the country. It is not intended to be a comprehensive listing of ALL GIS sites, just those which have come to their attention and been established as either interesting or important reference pointers to additional sources of information. It is intended that this list will continue to grow.</td></tr>
<tr><td>ADWR</td><td>Arizona Department of Water Resources
http://www.adwr.state.az.us
The Arizona Department of Water Resources (ADWR) is the state regulatory and planning agency that specializes in information about water supply and demand. The agency is primarily concerned with groundwater but also collects limited information on surface water.</td></tr>
<tr><td>ADWR</td><td>Arizona Department of Water Resources GIS sites
http://www.adwr.state.az.us/hydrology/GIS/adwrgis.htm
<table>
<tr><th>Source or Use</th><th>GIS Database</th><th>Extent</th><th>Topology</th></tr>
<tr><td>Wells</td><td>Well Registry</td><td>Statewide</td><td>Points</td></tr>
<tr><td rowspan="2">Water Levels</td><td>Elevation Contours</td><td>AMA</td><td>Lines</td></tr>
<tr><td>Groundwater Site Inventory</td><td>Statewide</td><td>Points</td></tr>
<tr><td rowspan="3">Irrigated Farms</td><td>Grandfathered Rights</td><td>AMA</td><td>Polygons</td></tr>
<tr><td>Irrigation Authorities</td><td>INA</td><td>Polygons</td></tr>
<tr><td>Irrigation Districts</td><td>Statewide</td><td>Polygons</td></tr>
<tr><td rowspan="3">Surface Water Claims</td><td>Stockponds</td><td>Statewide</td><td>Points</td></tr>
<tr><td>Points of Diversion</td><td>Statewide</td><td>Points</td></tr>
<tr><td>Places of Use</td><td>Statewide</td><td>Points</td></tr>
<tr><td>Groundwater Recharge</td><td>Recovery Wells</td><td>AMA</td><td>Points</td></tr>
<tr><td rowspan="2">Water Utilities</td><td>Service Areas</td><td>AMA</td><td>Polygons</td></tr>
<tr><td>Certificates of Convenience</td><td>Statewide</td><td>Polygons</td></tr>
<tr><td rowspan="3">Basins</td><td>Surface Watersheds</td><td>Statewide</td><td>Polygons</td></tr>
<tr><td>Groundwater Basins and Subbasins</td><td>Statewide</td><td>Polygons</td></tr>
<tr><td>AMA and INA</td><td>Statewide</td><td>Polygons</td></tr>
</table>
Note: ADWR does not have information on:
▪ Aquifers - See Groundwater Site Inventory under Water Levels
▪ Engineering infrastructure - Canals, laterals, pumps, valves, meters, etc.</td></tr>
<tr><td>ADWR</td><td>Arizona Department of Water Resources Bookstore
http://www.adwr.state.az.us/bookstore/default.htm
500 North Third Street, First Floor, Phoenix, AZ
Bookstore Phone: 602-417-2485 (within AZ only – 1-800-352-8488)
Bookstore Fax: 602-417-2488</td></tr>
</table>

If any reader believes any of the information above to be incorrect, please don't hesitate to contact me so that I can correct it. E.g.water use figures, locations, names misspelled, broken web links, etc. >> **gavinfieldingaz@yahoo.com**

<table>
<tr><td>Griffith Energy Project</td><td>A 720 MW combined cycle gas fired power plant in the Sacramento Valley north of Yucca adjacent to Highway 40. It is scheduled to go online by summer 2001. Expected water use is between 3000 - 4850 ac-ft per year. The county is committed to supplying 4850 ac-ft per year by contract.</td></tr>
<tr><td>Prison</td><td>A new 2000 bed prison along Highway 40, north of the Griffith Energy Plant is expected to use approximately 500 ac-ft per year.</td></tr>
<tr><td>ADEQ</td><td>Arizona Department of Environmental Quality
www.adeq.state.az.us
<table><tr><td>Phoenix Main Office
3033 N. Central Ave.
Phoenix, AZ 85012
(602) 207-2300
Toll Free in Arizona:
(800) 234-5677</td><td>Northern Regional Office
1515 E. Cedar Ave., Suite F
Flagstaff, AZ 86004
(520) 779-0313</td><td>Southern Regional Office
400 W. Congress, Suite 433
Tucson, AZ 85701
(520) 628-6733</td></tr></table>As the State of Arizona's lead agency for environmental concerns, ADEQ most often solicits for goods and services that are technically oriented. ADEQ has hired contractors to take and analyze water samples from water systems, drill wells to monitor groundwater quality, to plan and implement the cleanup of contaminated sites.</td></tr>
<tr><td>USDA</td><td>United States Department of Agriculture
http://www.usda.gov/
The USDA is the steward of the nation's 192 million acres of national forests and rangelands. The USDA is the country's largest conservation agency, encouraging voluntary efforts to protect soil, water, and wildlife on the 70 percent of America's lands that are in private hands</td></tr>
<tr><td>USDA NRCS</td><td>United States Department of Agriculture Natural Resources Conservation Service
http://www.nrcs.usda.gov/
The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, is the federal government agency that works hand-in-hand with the American people to conserve natural resources on private lands. Using their scientific and technical expertise, and their partnerships with conservation districts and others, they help people conserve all natural resources on private lands.<table><tr><td>Arizona NRCS State Headquarters
3003 N. Central Ave. Suite 800
Phoenix, AZ 85012-2945</td><td>Tel: 1-602-280-8801
http://az.nrcs.usda.gov/</td></tr></table>Conservation Assistance and Incentive Programs Available in Arizona
http://az.nrcs.usda.gov/ (then click Conservation Programs)</td></tr>
<tr><td>USDA NRCS</td><td>USDA NRCS Soil Survey Division
http://www.statlab.iastate.edu/soils/index.html
The Soil Survey Division is part of the Natural Resources Conservation Service's Soil Survey and Resource Assessment Deputy Area. It is responsible for providing leadership in planning, directing and coordinating a comprehensive soil survey program in support of the Agency's programs and priorities. This site also has the results of soil surveys and soil profile type.</td></tr>
<tr><td>USFWS</td><td>United States Fish and Wildlife Service
http://www.fws.gov/
The USFWS manage a wildlife preserve on the Bill Williams River that is in part dependant on the flows coming out of the Big Sandy River in the Big Sandy Valley.</td></tr>
<tr><td>USFS</td><td>United States Forest Service
http://www.fs.fed.us/</td></tr>
<tr><td>ADMMR</td><td>Arizona Department of Mines and Mineral Resources
http://www.admmr.state.az.us
ADMMR is a non-regulatory State agency that aids in the promotion and development of Arizona's mineral resources. This is accomplished through technical research, field investigations, disseminating information through publications and personal contacts, and by maintaining the Arizona Mining and Mineral Museum.</td></tr>
</table>

BLM Kingman Field Office	[The local Bureau of Land Management (BLM) in Kingman] manages nearly 2.4 million acres of public lands in Mohave and Yavapai Counties. These lands support a wide variety of different types of activities which serve an equally wide variety of people. These activities include recreation, mining, livestock grazing, fire management, realty, and various resource conservation programs including archaeology, wilderness, wildlife habitat management, and the wild horse and burro program

Bureau of Land Management Kingman Field Office 2475 Beverly Avenue Kingman, AZ 86401	Tel: (520) 692-4400 http://azwww.az.blm.gov/kfo/index.htm



	**The members of Kingman Field Office have been extremely helpful in this project and have such a wide range of skills and backgrounds that they could not possibly be covered in their website. But, the website does give a good idea of what the BLM does at the Kingman Office. http://azwww.az.blm.gov/kfo/index.htm

If any reader believes any of the information above to be incorrect, please don't hesitate to contact me so that I can correct it. E.g.water use figures, locations, names misspelled, broken web links, etc. >> **gavinfieldingaz@yahoo.com**

BLM	**Bureau of Land Management,** **(Department of the Interior)** http://www.blm.gov/nhp/index.htm http://www.doi.gov/ The Bureau of Land Management (BLM), an agency within the U.S. Department of the Interior, administers 264 million acres of America's public lands, located primarily in 12 Western States. The BLM sustains the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.
EPA	Environmental Protection Agency http://www.epa.gov/ The EPA is the Federal Level Agency that is most well known for it's role in cleaning up and contracting out Superfund sites. *(I am currently unaware of any superfund sites in Mohave County, Please e-mail me if you are aware of any @ gavinfielding@lycos.com)* To get postcode and watershed specific information on the topics below that are specific to your postcode or watershed go to: http://www.epa.gov/epahome/comm.htm ○ **Envirofacts:** Pollution, hazardous waste sites, and other regulatory information. [Go to Envirofacts home page] ○ **EnviroMapper:** "Live" and customizable computer-generated maps of regulated sites throughout the United States. [Go to EnviroMapper home page] ◉ **Surf Your Watershed:** Environmental conditions and activities in watersheds throughout the United States. [Go to Surf Your Watershed home page] ○ **UV Index:** Ultraviolet (UV) Index Forecast A daily forecast of the expected intensity of Ultraviolet radiation from the sun. [Go to SUNWISE home page]
EPA	**Environmental Protection Agency – Office of Pesticide Programs** If you use or intend to use pesticides on your property, the Office of Pesticide Programs website should be consulted because it has specific instructions on the use and location of use of pesticides. These have been developed to minimize the detrimental effects on ground/surface water supplies. http://www.epa.gov/oppfead1/endanger/arizona/mohav.htm
Phelps Dodge Bagdad Mine **Aka the "Bagdad Mine"**	The Phelps Dodge Bagdad Copper Mine is a large copper mine ESE from the southern end of the Big Sandy Valley. It appears that they have bought up most of the water rights all along the length of the Big Sandy Valley. One estimate of extraction from the Big Sandy Valley shallow aquifer puts it close to 8000 ac-ft per year. The Bagdad mine is actually in Yavapai County but is on a creek which flows into Mohave County. The operations consists of an open–pit copper molybdenum mine, an 85,000 ton-per-day concentrator, a dump leach operation, and an SX-EW plant. The company reports that Bagdad has over a billion ton proven and probable ore reserve of 0.38 percent copper and 0.021 percent molybdenum.
Arizona Mining Association	**The Arizona Mining Association** has a website to educate and inform the public about mining operations in Arizona. http://www.azcu.org/
NCDC	**National Climatic Data Center** http://www.ncdc.noaa.gov/ NCDC is the world's largest active archive of weather data. NCDC produces numerous climate publications and responds to data requests from all over the world. NCDC Subscriptions Services Center 310 State Route 956 Building 300 Rocket Center, WV 26726 Tel: 1-866-742-3322 (toll free) 1-828 271-4010 (TDD) Fax: 1-304-726-4409 http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwAW~MP

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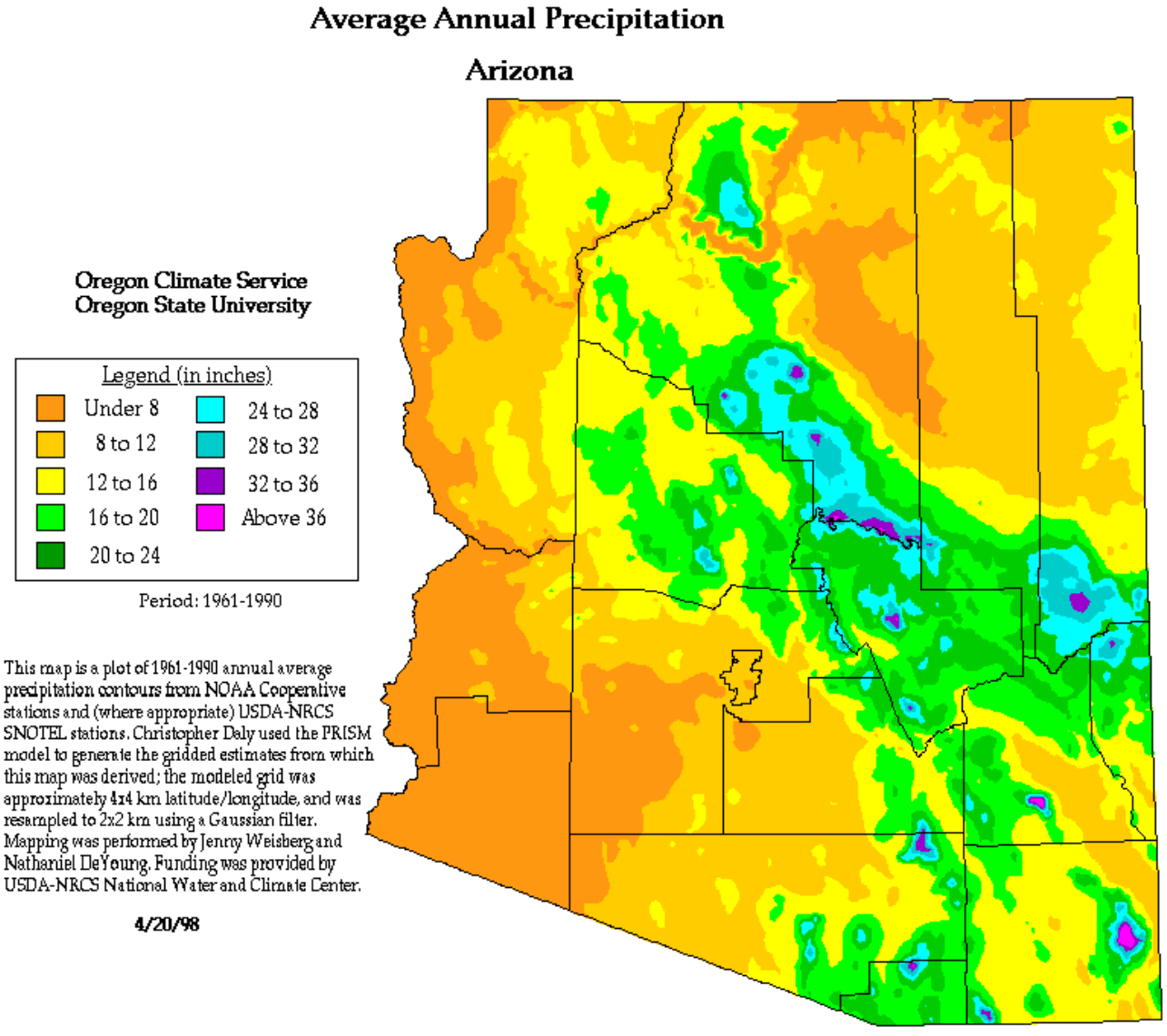
Arizona State Climatologist	**Office of the Arizona State Climatologist** http://geography.asu.edu/azclimate/ The state climate program was established by the Arizona Board of Regents in September 1973 in a Memo of Agreement with the National Weather Service - Western Region, the National Climatic Data Center, and Arizona State University. The purpose of the program is to disseminate climatological information about the State of Arizona to the general public. It is based in the geography department at Arizona State University.

Satellite images **Daily updated*	**Current Observations** **Daily updated*	**Forecasts for Phoenix, Tucson and Flagstaff**



N.B.>>More Local knowledge has shown that there is 24+ inches of rainfall each year on the Hualapai Mountains. Depending on the altitude and which side of the mountain ranges you are on the rainfall varies
*This graphic is from the Arizona State Climatologists office.

Water Surveys	**Water Surveys of Sedona, AZ** prepared a water survey for the proposed Cedar Ridge Subdivision in the Hualapai Watershed between Oct 1995 and April 1997. I haven't been able to confirm whether the company still exists or operates under a different name. **This report has a very good summary of water surveying and the geology of the area including the techniques behind the successful siting of a producing well.
Mt Tipton Water Company	The Mt Tipton Water Company is a small water supplier for the town of Dolan Springs.

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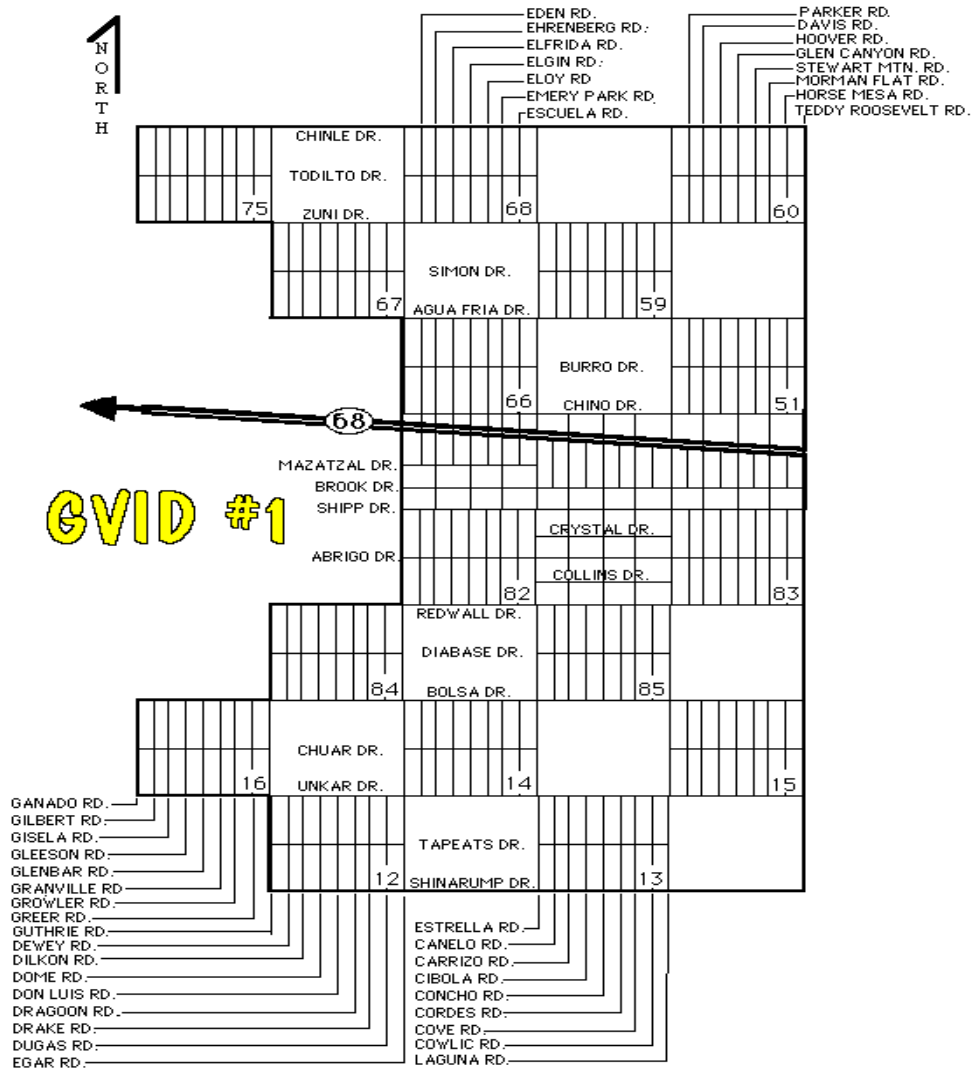
WAPA	**Western Area Power Administration** http://www.wapa.gov/ Western Area Power Administration markets and delivers electric power and related services within a 15-state region of the central and western U.S. They are one of four power marketing administrations within the U.S. Department of Energy whose role is to market and transmit electricity. WAPA and its energy-producing partners are separately managed and financed. In addition, each water project maintains a separate financial system and records.
GVID #1	**The Golden Valley Improvement District #1** was formed by the residents in the area in the late seventies to provide a vehicle to develop water over the 31 square miles of privately owned land in the area. While those running the district in the early years worked hard and gave much time and effort, the district really didn't start sinking wells and running water lines for almost 10 years. Today there are about 600 water meters serving residents in the area with the ever expanding grid offering the opportunity for many more to hook up. Because improvement districts are maintained and services constructed are financed by assessments and the potential for taxation, current status of these assessments at a time of sale is a consideration for both buyer and seller. There are approximately 3,500 residents in this area.

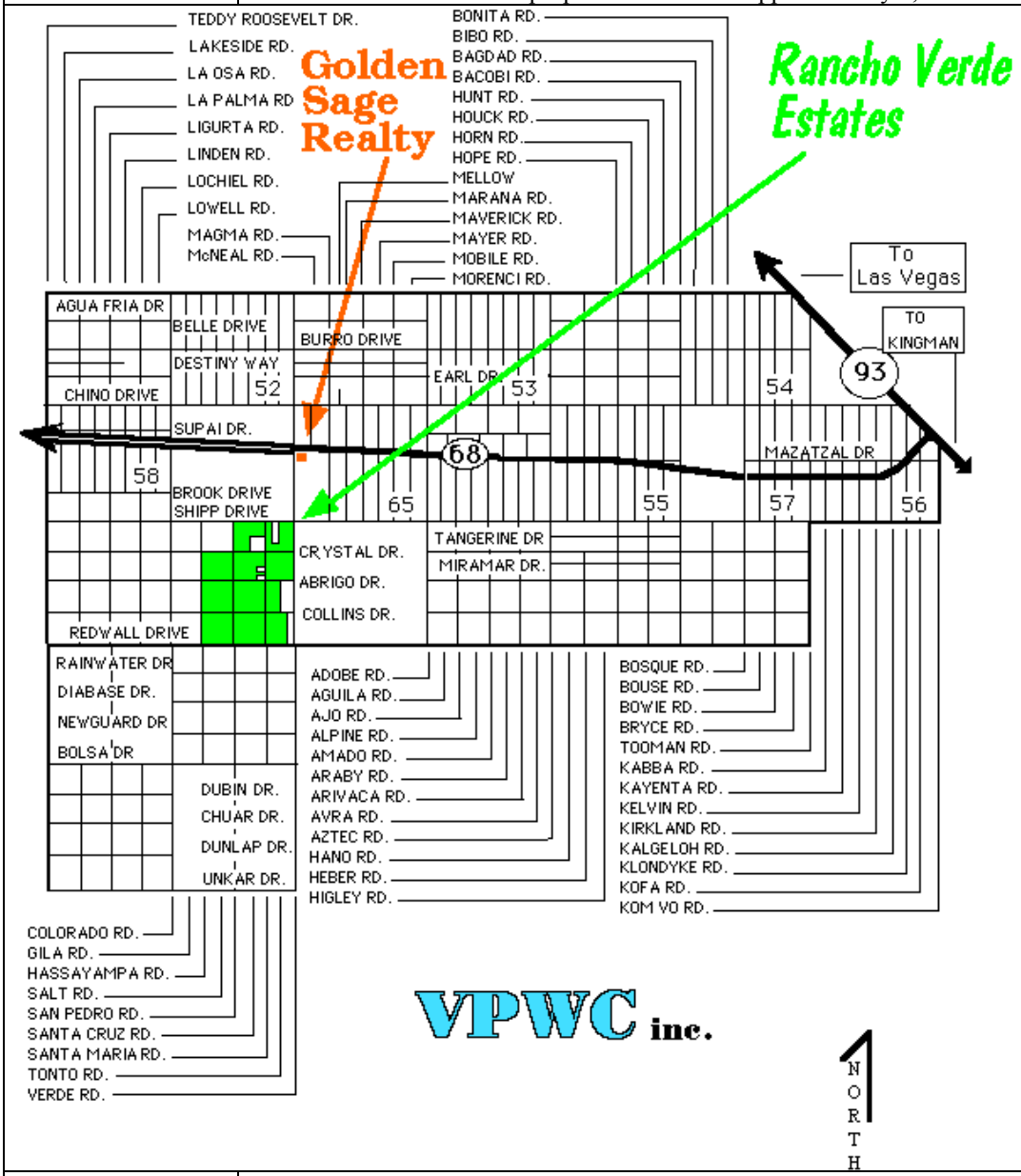


AZ State Parks	**Arizona State Parks** http://www.pr.state.az.us/ Although there are no state parks in the Watersheds Assessed in this study, they are still an important part of watershed, county and state level decisions across Arizona.

Arizona State Parks 1300 W. Washington Phoenix, Arizona 85007	Tel & TTY (602) 542-4174 Fax (602) 542-4180

If any reader believes any of the information above to be incorrect, please don't hesitate to contact me so that I can correct it. E.g.water use figures, locations, names misspelled, broken web links, etc. >> **gavinfieldingaz@yahoo.com**

NW Watershed Council	**The Northwest Arizona Watershed Council** The council is a volunteer based organization that deals with a wide variety of watershed based issues and local policy decisions. Some examples of the work done by the council are the identification of the need for the centralized source of information (part of the purpose for this project); and managing the allocation of the funds from a grant by the ADEQ to clean up wildcat dumps and limit future dumping through public education. Meetings: Generally the 3rd Wednesday of each month at 4.30pm in the BLM Kingman Field Office. All are welcome.. E-mail: imspirit@kingmanaz.net or cleo@ctaz.com
Valley Pioneers Water Company	**Valley Pioneers Water Company Inc. (VPWC inc.)** was formed by Sacramento Valley Pioneers, a now dormant homeowners organization, in the early sixties and is a non-profit, privately owned (by the meter holder property owners) water company. Currently this company serves approximately 1,500 meters spread over about 70 miles of water lines in the 24 square mile service area. This company has no taxation or assessment authority, although the Rancho Verde Estates subdivision within the VPWC service area has a road-improvement-only district that is subject to assessments on some of its properties. There are approximately 4,200 residents in this area.



Newspapers	**The Kingman Daily Miner Newspaper** http://www.kingmandailyminer.com/ The newspaper for Kingman and the surrounding area. **Mohave Daily News** http://www.mohavedailynews.com/ A Bullhead City based newspaper that covers news in Mohave County.

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<table>
<tr><td>Mohave County</td><td>Mohave County Homepage
http://www.co.mohave.az.us/</td></tr>
<tr><td>Mohave county P& Z Commission</td><td>Mohave County Planning and Zoning Commission
http://www.co.mohave.az.us/1moweb/depts_files/planzone.htm
The Planning and Zoning Department provides professional, strategic, and technical leadership and facilitation to ensure that Mohave County maintains an acceptable quality of life; has beneficial, managed growth; and has an effective voice in the land management decisions of the Federal and State Governments.
The Planning Division amends and administers adopted County plans and the subdivision regulations. This division is working on amendments to the subdivision regulations and formulating various area plans. http://www.co.mohave.az.us/1moweb/Planning.htm
The division also formulated plans for the I-40 corridor, Golden Valley, the Long Mountain area and one other area identified by the Planning and Zoning Commission and the Board of Supervisors. The Planning Division also administers the County’s rural addressing system, which supports the 911 system. This Division coordinates the County’s Census 2000 effort and the Local Address Update effort through the U.S. Census Bureau. The Planning Division provides staff support to the Planning and Zoning Commission (12+ meetings / year), the Board of Supervisors (12-24 meetings / year), the Public Land Use Committee (12+ meetings / year) and the Overall Economic Development Committee (4+ meetings / year).
The Zoning Division amends, monitors and administers the Mohave County Zoning Ordinance and the Nuisance Abatement Ordinance. This Division is currently working on completion and adoption of Zoning Ordinance amendments; Official Mohave County Zoning Maps and related data bases; completing necessary component for a functioning hearing officer; completion of land use and related data bases; staffing and issuing both building and zoning permits and electronic permit files. This division provides staff support to the Planning and Zoning Commission (12+meetings per year), the Boards of Adjustment (3 Boards/9+meetings per year), and the Board of Supervisors (12-24 meetings per year). http://www.co.mohave.az.us/1moweb/Zoning.htm</td></tr>
<tr><td>City of Kingman</td><td>City of Kingman
http://www.cityofkingman.gov/
The city of Kingman is the county seat for Mohave County. It is a rapidly growing city that is aggressively marketing itself to attract new businesses and jobs to the area.</td></tr>
<tr><td>Kingman Chamber of Commerce</td><td>Kingman Chamber of Commerce
http://www.kingmanchamber.org/ (A very impressive website!)
Their mission statement is to “To promote and support the business environment through membership participation and pro-active leadership that fosters economic growth and community involvement”.
<table><tr><td>Kingman Chamber of Commerce
120 West Andy Devine, P.O.Box 1150
Kingman, AZ 86402-1150</td><td>Tel: (520) 753-6253
Fax: (520) 753-1049
E-mail: info@kingmanchamber.org</td></tr></table></td></tr>
<tr><td>Mohave County</td><td>Mohave County Economic Development Authority, Inc.
http://www.mcedaarizona.com/
Providing services to facilitate the setting up of businesses and jobs in Mohave County.
For example, the authority assisted with the site development for the Griffith Energy Plant.
Unfortunately this organization has many critics who question it’s independence.
<table><tr><td>Mohave County Economic Development Authority
3160 Shangri La Drive
Kingman, Arizona 86401</td><td>Tel: 520 692 6970
Fax 520 692 6974</td></tr></table></td></tr>
<tr><td>Watershed Information Newsletter</td><td>Watershed Information Newsletter
This newsletter includes Information on upcoming meetings, Summaries of meetings past, Professional and personal development opportunities, New laws, Tips on personal health and working with groups, and fun stuff. In other words, it tries to network the people of AZ with their many varied interests, and make it fun to read as well. Many of the items found in the newsletter originate from individuals in the watersheds, or are based in an e-mail someone has sent requesting this type of information.
If you would like to contribute to the newsletters, or subscribe to the distribution list please e-mail the author Dan Salzler at Azwatershed@aol.com</td></tr>
</table>

Nature Conservancy	**The Nature Conservancy** http://nature.org/ The Nature Conservancy is a nonprofit organization founded in 1951, It is the world's largest private international conservation group.
Environmental and Business Conflict Resolution	**Environmental and Business Conflict Resolution** http://conflictdispute.com It is the mission of Environmental and Business Conflict Resolution to resolve and or manage conflicts and disagreements between individuals, agencies, groups or businesses to the mutual benefit of all. Fax: 1-623-930-0701 E-mail: ESConflict@aol.com
University of Arizona	**Hydrology and Water Resources Department** http://www.hwr.arizona.edu/ Department of Hydrology and Water Resources Harshbarger Building, University of Arizona Tucson, AZ 85721-0011 Tel: 1-520-621-7120 Fax: 1-520-621-1422
University of Arizona	**School of Renewable Natural Resources** http://www.srnr.arizona.edu/ School of Renewable Natural Resources 325 BioSciences East University of Arizona Tucson AZ 85721 Tel: 1-520-621-5211 Fax: 1-520-626-7401
ADOT	**Arizona Department of Transport** http://www.dot.state.az.us/ The continued population expansion in the region will force the expansion of their program of road paving, road building and road maintenance.
Arizona Game and Fish	**Arizona Game and Fish** http://www.gf.state.az.us Arizona Game and Fish deals with hunting and Fishing licensing and regulations. Online they have the 2001-2002 hunting regulations and 2001 fishing regulations in PDF format.
USGS	**United States Geological Survey** http://www.usgs.gov/ The USGS is often the first place for people to search for information. The Survey has a huge knowledge base amongst its staff and has produced numerous publications on the geology of Arizona. The USGS also does stream gauging. The spreadsheet in the next file on "Documents already gathered" has the data for the **30** stream gaging sites within Mohave county through hotlinks to the USGS web database. http://water.usgs.gov/usa/nwis/
USGS	**United States Geological Survey Water Resources Division** http://water.usgs.gov/ Although the Arizona Department of Water Resources has taken over the task of monitoring well levels and water quality, the USGS does have all the data collected up until 1995 when the two databases stopped being synchronized. The USGS does a large amount of work on monitoring water quality throughout the country. In Arizona they have mainly focused on the effects of mine tailing drainage into watercourses.
Arizona Department of Agriculture	**Arizona Department of Agriculture** http://agriculture.state.az.us/ Their mission Statement is to regulate and support Arizona agriculture in a manner that encourages farming, ranching, and agribusiness while protecting consumers and natural resources. 1688 West Adams Phoenix, AZ 85007 Tel: (602) 542-4373

Arizona State Land Department 1616 West Adams Phoenix AZ 85007	**Arizona State Land Department** http://www.land.state.az.us/ Their Mission Statement is to manage state trust lands and resources to enhance value and optimize economic return for the Trust beneficiaries, consistent with sound stewardship, conservation and business management principles supporting socio-economic goals for citizens here today and generations yet to come. To manage and provide support for resource conservation programs for the well-being of the public and the state's natural environment. **The Operations Division of the Arizona State Land Department** Tel: (602)-542-4602 The Operations Division is responsible for ensuring the integrity of the State's land ownership title, managing public records, coordinating applications and the preparation of leases, permits and other contracts associated with the surface use of the state's 9.3 million acres of trust land. The division administers various activities associated with federal land condemnations, administrative hearings, litigation, and other legal issues that come before the department. The division is responsible for cadastral surveys and land legal descriptions plus other land survey issues involving Trust land. **The Natural Resources Division** Tel: (602)-542-4625 http://www.land.state.az.us/asld/htmls/natural_99.htm administers all natural resource-related leases, Natural Resource Conservation Districts and any natural resource issue affecting State Trust land. Leasing categories include grazing, agriculture, mineral, mineral material, exploration, and apiary. Other areas of natural resource administration include water sales, mineral material sales, water rights administration, trespass, environmental contamination, and cultural resources. The Division's Programs are manage in six sections:\ ▪ **Range Section** ▪ **Natural Resource Conservation Section** ▪ **Minerals Section** ▪ **Water Rights Management Section** Manages the following: surface water rights (including applications, permits, certificates and registrations), grandfathered groundwater rights (irrigation, type 1 and type 2), wells, and a Central Arizona Project (CAP) water allocation of 34,576 acre-feet, and a Colorado River contract for State Trust lands. The section conducts site investigations for new uses, safety, trespass, location verifications, etc. Water Rights also conducts water resource evaluations on land sales, lease assignments and lease applications. Additional responsibilities include: assessing water charges on leases, facilitating public auction water sales, negotiating Colorado River contracts, and managing the Trust's CAP water allocation. ▪ **Environmental Resources and Trespass Section** ▪ **Urban and Community Forestry Section** **Fire Management Division** Tel: (602)-255-4059 http://www.land.state.az.us/asld/htmls/fire.html The Division provides for the prevention and suppression of wildfires on state and private lands, located outside incorporated municipalities, through the use of cooperative agreements with local fire departments, other state and federal agencies and persons organized to prevent and suppress wildfires. The division also maintains in-house overhead and firefighting capabilities through the qualifications of its own employees. (They cover 22,400,000 acres of State and Private Land) **Real Estate Division** Tel: (602)-542-1704 http://www.land.state.az.us/asld/htmls/realestate_99.html The real estate market continued to be strong in Arizona as a result of the explosive population growth throughout the state. To meet the market demand for residential and commercial properties, the Department offered for lease and sale properties within the growth path of the major metropolitan areas. In addition, the Division worked with communities to foster well balanced land planning and design criteria for Urban Trust Lands. It is divided into: ▪ **Sales Section** ▪ **Commercial Leasing Section** ▪ **Right of Way Section** ▪ **Appraisal Section** Arizona Preserve Initiative The Arizona Preserve Initiative (API) was passed by the Arizona State Legislature as HB 2555 and signed into law by the Governor in the spring of 1996. It is designed to encourage the preservation of select parcels of state Trust land in and around urban areas for open space to benefit future generations. The law lays out a process by which Trust land can be leased for up to 50 years or sold for conservation purposes. Leases and sales must both occur at a public auction.

<table>
<tr><td>AGS</td><td><u>Arizona Geological Survey</u>
http://www.azgs.state.az.us/
The Arizona Geological Survey collects and archives information about the geologic character, processes, hazards, and mineral and energy resources of Arizona. It also aims to inform, advise, and assist the public in order to foster understanding and prudent development of the State's land, water, mineral, and energy resources. They have geological maps at 1:100,000 scale for the entire state in paper form and digital form.
The Geology Library at the AGS
The AZGS library contains more than 25,000 volumes, including all publications of the AZGS and its predecessors, the Arizona Oil and Gas Conservation Commission, and selected publications of other governmental agencies. The library also contains theses and dissertations on Arizona geology, selected technical journal and bulletin series, textbooks, environmental impact statements and reviews, and unpublished maps and reports on the geology, water, energy, and mineral resources of Arizona. The library, supervised by T. G. McGarvin, is open to the public
<table>
<tr><td>Arizona Geological Survey
416 W Congress St., Suite 100
Tucson, Arizona 85701</td><td>Tel: 1-520-770-3500</td></tr>
</table></td></tr>
<tr><td>WRRC</td><td><u>Water Resources Research Center</u>
http://ag.arizona.edu/AZWATER/main.html
The Arizona Water Resources Research Center (WRRC) was established in 1957 to facilitate university research at all three Arizona universities on water problems of critical importance to the state and region. Located within the College of Agriculture at the University of Arizona, the WRRC administers the Federal 104 grant program authorized by the Water Resources Research Act of 1964. Related missions are to communicate water-related research needs from research users to researchers and to report research findings to potential users of that information. The WRRC also works with public and private organizations and individuals and provides information and services through a publications program, including two newsletters, conferences and symposia, and through outreach
<table>
<tr><td>The Water Resources Research Center
College of Agriculture and Life Sciences
The University of Arizona
350 North Campbell Ave.
Tucson, AZ 85719</td><td>Phone: 1-520-792-9591
FAX: 1-520-792-8518
Email: wrrc@ag.arizona.edu</td></tr>
</table></td></tr>
<tr><td>USBR</td><td><u>United States Bureau of Reclamation</u>
http://www.usbr.gov/main/index.html
Today, the bureau is a contemporary water management agency with a strategic plan outlining numerous programs, initiatives and activities that will help the Western States, Native American Tribes and others meet new water needs and balance the multitude of competing uses of water in the West.</td></tr>
</table>